



UNIT 2 - FUELS

SECTION 4 - ACROSS THE CURRICULUM (SOCIAL STUDIES)



TOUR DE TEXAS

Background Information

Any transportation fuel other than gasoline or diesel is considered an alternative fuel. Alternative fuels can be more economical, especially over the long run, because some are less expensive than conventional fuels and are easier on the engine. Also, they reduce the United States' dependence on foreign sources of petroleum and can contribute to cleaner air by emitting less pollution.

Two problems with getting people to switch to cleaner energy sources are that the fuels are unfamiliar and not as widely available as gasoline and diesel. The two most widely available alternative fuels in Texas are compressed natural gas and propane.

For most transportation uses, natural gas is **compressed** in cylinders at 2,500-3,000 psi (**pounds per square inch**) and is referred to as compressed natural gas or CNG. Sometimes CNG-fueled vehicles are called NGVs, for natural-gas vehicles. Clean exhaust is a CNG strong point. Studies have shown a 44 percent reduction in non-methane hydrocarbons (NMHC) compared to gasoline, and a nearly 100 percent reduction in particulate pollution.



Showing the Way

Supporters of propane and natural gas as vehicle fuels have held road trips crossing the continent to prove the utility of their power sources. The primary point of these journeys was to show each fuel's **distribution** and **retail network**. This network, often called the refueling **infrastructure**, was developed to support a cross-country trek. The concept of driving across the country to prove a point isn't new. The U.S. Army staged a caravan in 1919 to demonstrate the potential of motor vehicles for military use and to dramatize the need for better highways.

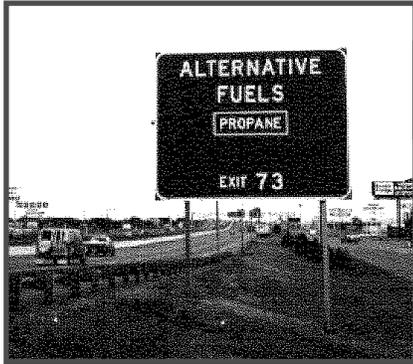
The 42 vehicles left the White House on July 7, 1919, and didn't make it to San Francisco until Sept. 6, 1919. The intrepid party was met with a parade and a speech by California's governor.

The most important influence the exercise had was on a young officer, Capt. Dwight D. Eisenhower, who helped lead the caravan across poor and non-existent roads.

"The old convoy," he wrote later, "had started me thinking about good, two-lane highways." Decades later, as President of the United States, Eisenhower championed as a national defense measure the vast system of Interstate highways that we rely on today.



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Highway signs such as these indicate that alternative-fuel stations are nearby.



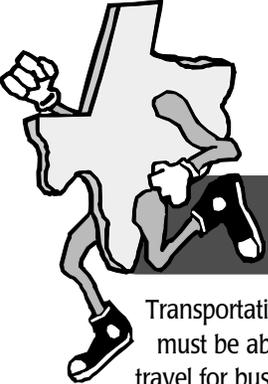
Signs of the Times

Texas was the first state to put up highway signs along Interstates to tell motorists where to find alternative fueling stations.

The signs help travelers find propane and natural gas, and they are a reminder that alternative fuels are becoming more available every day. The Texas Railroad Commission cooperated with the Texas

Department of Transportation to put up signs at several locations.

Next time you're traveling an Interstate, look for the signs in Abernathy, Abilene, Amarillo, Beaumont, Brookshire, Canton, Cisco, El Paso, Midland, San Antonio, Shamrock, Sonora, Van Horn, Waco, and Weatherford.



Texans on the Go!

Transportation affects every Texan. We must be able to commute to work, travel for business or pleasure, run errands, and meet our daily health and safety needs. Texas businesses must be able to move goods between producers, distributors, and consumers. Our quality of life and economic well-being depend upon access to efficient, economical transportation facilities and services.

Texans are concerned about meeting their transportation needs for the next 20 years and beyond. Texas is establishing policies, strategies, and actions to improve one of the largest transportation systems in the nation.

- ✦ Texas has more roads (almost 300,000 miles) and bridges (more than 48,000) than any other state.
- ✦ Texas has 400 public-use airports, more than any other state.
- ✦ Approximately 90 percent of Texans

live within a one-hour drive of an airport with commercial service.

- ✦ Texas has more miles of rail than any other state – 11,370.
- ✦ Texas has the nation's third most active canal – the Gulf Intracoastal Waterway.
- ✦ There are 41 freight railroads operating across Texas.
- ✦ The Port of Houston is the nation's second largest in terms of tonnage shipped.
- ✦ The ports of Corpus Christi, Texas City, and Port Arthur also rank among the largest in the U.S.
- ✦ Texas is home to 71 transit systems, both in urban and rural areas.
- ✦ Austin, Dallas, San Antonio, and Houston are four of the 50 largest transit bus markets in North America.

In the next 20 years it is estimated that...

- ✦ Transit ridership in Texas will grow 25 percent.
- ✦ Freight transport by ship to and from foreign ports will grow by 9 percent.
- ✦ The number of vehicle miles traveled on state roadways will increase 45 percent.
- ✦ The number of air travelers using Texas airports will more than double.
- ✦ Truck-borne freight transportation in Texas will grow 45 percent.
- ✦ Rail shipments originating in Texas will increase 23 percent.

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Propane, also called liquefied petroleum gas or LP-gas, can be compressed into a liquid at 100-200 psi. About two-thirds of U.S. propane is derived from raw natural gas, and the rest is derived from crude oil. Propane is a clean-burning fuel. Studies have shown a 44 percent reduction in NMHCs compared to gasoline. Like natural gas, propane reduces particulates by nearly 100 percent.

In this activity you will plan and calculate a trip through Texas using an alternative fuel.

Materials

For each group:

Propane scenario (Figure 2-4-13) or

CNG scenario (Figure 2-4-14)

Tour de Texas conditions (Figure 2-4-15)

Travel agenda (Figure 2-4-16)

Blank check vouchers (Figure 2-4-17)

Balance sheet (Figure 2-4-18)

notebook paper

Texas Propane Services Directory

Official Texas Highway Travel Map

CNG refueling stations can be located at www.afdc.nrel.gov/refueling-html

Procedure

1. Your teacher will group you into teams.
2. Using your own paper, predict the following:
 - a. How far do you think your team can travel on \$50 worth of an alternative fuel?
 - b. How many sights do you think your team will see?
 - c. How many times do you think your team will have to refuel?
 - d. How long will your trip take?
 - e. What problems might you have?

These will be used later to compare with the final outcome of the trip.

3. Read the scenario handout (Figure 2-4-13 or 2-4-14). Your goal is to see as many sights as possible on your vacation, but there are conditions! Read the conditions on figure 2-4-15.
4. According to information on the scenario, calculate the following:

How much fuel can you buy with \$50?

How many miles will that take you?

How many miles can you travel per tank?

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5. Decide where you are going to start your trip. You may start from any city, but you must return to the same city at the end of your trip. Record your starting location on the Travel Agenda (Figure 2-4-16).
6. Decide on a general direction for your trip. Look at your map and refueling directory to plan where you can purchase fuel. Depending upon your location, you may wish to take a longer trip and stop frequently, or you may wish to go straight to an area with many attractions close together.
7. Now plan your trip. Try to see as many sights as possible – visiting a place twice doesn't count. Decide which routes to take, making sure there are refueling stations available when you will be low on fuel.
8. Your tank is empty, so before you take off on your adventure you must locate a fueling station and fill up. Each time you refuel, use the vouchers to record the costs (Figure 2-4-17). Use the balance sheet to keep track of how much money you have left and record where you refueled (Figure 2-4-18).
9. Use the travel guide and other brochures to make "postcards" of the places you visit. Illustrate the place visited and write a message to your sponsor about that site on each postcard. The message should also contain a math story problem that includes facts and information on how you arrived at that location.
10. Compare your actual outcomes with your predictions.
11. Put the paper with your predictions and comparisons together with your group's travel agenda, balance sheet, checks, and post cards. These will be turned in after your presentation.
12. Prepare to show your postcards in a class presentation on your trip.

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 INVESTIGATION CONT.**


Tour de Texas

Congratulations! A generous anonymous sponsor has presented you with a unique opportunity to see the sights of Texas. You have free food, lodging, and spending money! You have use of a car (powered by clean-burning propane), a road map of Texas, and a directory of propane refueling stations. Great, huh?

“What’s the catch?” you may ask. Well, there are a few:

- 

You can only spend \$50 on fuel. In 2000, propane averaged \$1.15 cents a gallon. Your tank holds 10 gallons and you can expect 24 mpg.
- 

You must fill out a fuel voucher every time you fill up. Your eccentric sponsor doesn’t want you to use your own money to supplement your fuel supply. So, your vehicle has a device that reads the voucher before you give it to the station attendant. If the voucher is not filled out for the amount you’ve just put in the tank, the car won’t start! This means that if you spend your \$50 before you make it home, you’ve got to walk the rest of the way – which would be a major bummer.
- 

To help you track your fuel use and money remaining, fill out the balance sheet provided when you refuel.
- 

Your sponsor wants to get a postcard from every place you visit.

It’s a Monday morning at 8 a.m. You’re ready to fill up and roll. Don’t forget to make sure the propane stations you intend to use offer vehicle refueling. Hit the road and have fun!

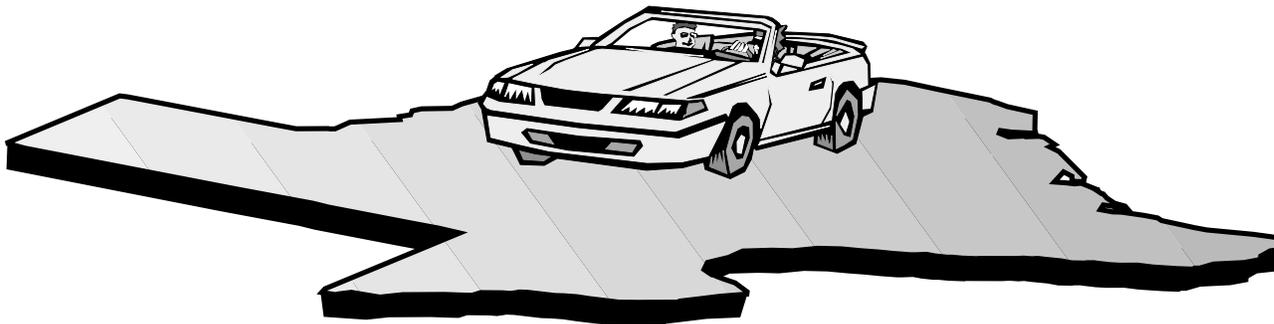


Figure 2-4-13 Propane scenario

**TOUR DE TEXAS
INVESTIGATION CONT.**



Tour de Texas

Congratulations! A generous anonymous sponsor has presented you with a unique opportunity to see the sights of Texas. You have free food, lodging, and spending money! You have use of a car (powered by clean-burning natural gas), a road map of Texas, and a list of CNG refueling stations. Great, huh?

“What’s the catch?” you may ask. Well, there are a few:

You can only spend \$50 on fuel. On the average, natural gas costs 65 cents a gallon. Your tank holds 10 gallons and you can expect 15 mpg.



You must fill out a fuel voucher every time you fill up. Your eccentric sponsor doesn’t want you to use your own money to supplement your fuel supply. So, your vehicle has a device that reads the voucher before you give it to the station attendant. If the voucher is not filled out for the amount you’ve just put in the tank, the car won’t start! This means that if you spend your \$50 before you make it home, you’ve got to walk the rest of the way—which would be a major bummer.



To help you track your fuel use and money remaining, fill out the balance sheet provided when you refuel.



Your sponsor wants to get a postcard from every place you visit.



It’s a Monday morning at 8 a.m. You’re ready to fill up and roll. Don’t forget to make sure the CNG stations you intend to use offer vehicle refueling. Hit the road—and have fun!

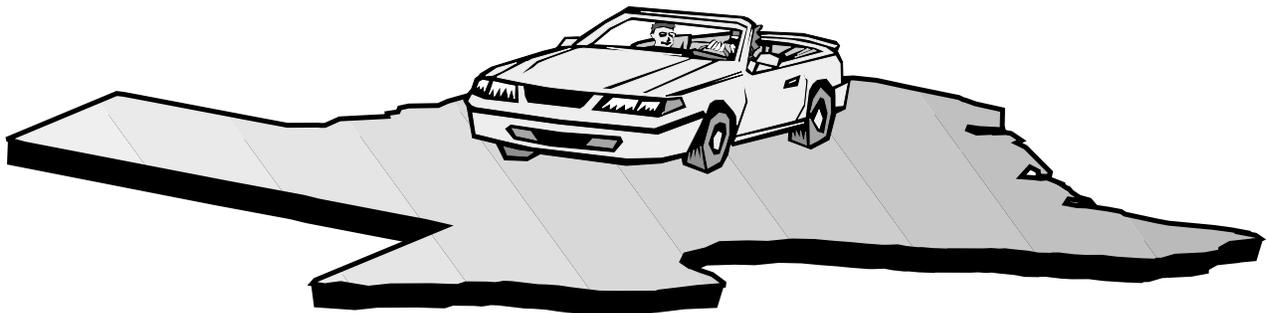


Figure 2-4-14 CNG scenario

**TOUR DE TEXAS
INVESTIGATION CONT.**

Tour de Texas Conditions



You need to try to see as many sights as you can, but your visit at each place cannot be less than an hour.



The sponsor wants you to adhere to the speed limits. To aid in scheduling, use an average figure of 55 mph for your speed on non-Interstate highways, 65 mph for Interstates. This factors in lower speed limits through towns, other slowdowns, and stops.



Get plenty of rest. Schedule at least eight hours for sleeping.



Keep up your strength. Plan a half-hour stop for breakfast and an hour each for lunch and dinner (or dinner and supper, depending on where you are!) No take-out allowed – your sponsor wants you to enjoy your meal when you're eating and concentrate on the road when you're driving.



Not all refueling stations are open all the time. If you're using propane, the directory lists the hours of operation. Assume the others are open Monday-Saturday 9 a.m. to 6 p.m.

Figure 2-4-15 Additional restrictions

<p>_____ No. 56-78/1234</p> <p>_____ 20 _____</p> <p>PAY TO THE ORDER OF \$ <input type="text"/></p> <p>Dollars</p> <p>LOAN STAR BANK Anywhere, Texas</p> <p>For _____</p> <p>⑆ 1 2 3 4 ⑆ 5 6 7 8 ⑆</p>	<p>_____ No. 56-78/1234</p> <p>_____ 20 _____</p> <p>PAY TO THE ORDER OF \$ <input type="text"/></p> <p>Dollars</p> <p>LOAN STAR BANK Anywhere, Texas</p> <p>For _____</p> <p>⑆ 1 2 3 4 ⑆ 5 6 7 8 ⑆</p>
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Figure 2-4-17 Blank checks

Group # _____

Period: _____

Company Name: _____

Group Members:

Check number	Date	Payee	Check amount and balance
			amount
			balance
			amount
			balance
			amount
			balance
			amount
			balance
			amount
			balance
			amount
			balance
			amount
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			amount
			balance
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			amount
			balance

Figure 2-4-18 Balance sheet

**TOUR DE TEXAS
INVESTIGATION CONT.****Tour de Texas Resource List**

www.texashighways.com

Texas Department of Transportation

Monthly magazine about Texas' natural and cultural resources, historical attractions, festivals, exhibits and travel adventures.

www.traveltex.com/high/home.asp

Texas Department of Economic Development

Texas tourist information about cities, attractions, events, camping sites, accommodations, tours.

www.afdc.nrel.gov/refueling.html

Alternative Fuels Data Center, National Renewable Energy Laboratory, U.S. Department of Energy
Lists LPG, CNG, LNG, M85 and E85 refueling stations and electric charging stations in the United States.

www.mapquest.com

MapQuest.com, Inc.

U.S. and international street maps, road atlases, driving directions, city and travel guides.